IN THE DRAWINGS

Herewith as **ATTACHMENT A** please find "Annotated Marked-up Drawings," consistent with 37 CFR §1.121(d)(1) and labeled as such, showing proposed changes to the figures, more particularly:

> **a single revised sheet, 7/20, including FIG. 7C, as originally filed, in addition to FIGS. 7(a) and 7(b); and,**

> **a single revised sheet, 2/20, including FIG. 2, reflecting the substitution of reference numeral 51 for 50.**

REMARKS

As a preliminary matter, the international application forming the basis of the subject national application was amended, consistent with PCT Art. 34 and Rules 46.5 and 66.8, in Applicant's paper captioned "Response to 1st Written Opinion," September 24, 2004. In addition to amendment of the specification, three (3) occurrences (i.e., in the title, at page 10, and at page 32), claims 1, 2, 5, 7, 9, 12, 14-17, 19, 22, 25, 27, 28, and 30 were amended, claims 18 and 29 canceled without prejudice, and new claims 31-50 added. No PCT Art. 19 amendments have been made, nor are further international application amendments contemplated.

As to the proposed amendments to the drawings and specification, they are provided for the sake of clarity and/or to correct inadvertent errors recently detected therein. With regard to replacement sheet 7/20, it now again includes FIG. 7(c) which had been inadvertently omitted in the substitute drawing sheets supplied to the Receiving Office, i.e., USPTO, March 9, 2004. No new matter has been added by way of said amendments.

As to the proposed claim amendments, claims 34, 36-45, 47, and 48 have been amended for the sake of clarity, more particularly, to emphasize the nature of the input to the interval consistency solver. "Geometry," e.g., a sequence of "Dim" functions that form or define a "system," is the solver input, or alternatively, the geometric functions comprising the "scene" comprise the input.

Regarding the Report, more particularly administrative matters relating thereto, it appears that although the Report is based upon the claims amended September 24th, amended sheets 35-47 returned therewith, no acknowledgment of description amendments is indicated, i.e., Report, Box I(1). Furthermore, we note that the Report indicates that it was established as if no priority was claimed due to a failure to furnish a copy of the priority document within the prescribed time limit, i.e., Report, Box II(1).

As a factual matter, a NOTIFICATION CONCERNING SUBMISSION OR TRANSMITTAL OF PRIORITY DOCUMENT, mailed February 20, 2004, indicates receipt by the International Bureau, February 13, 2004, of Applicant's priority documents, a copy herewith as **ATTACHMENT B**. It is respectfully requested that the Office address these administrative issues in their next correspondence with Applicant.

Substantively, and with respect to Box V(1) of the Report, the "Statement" with regard to novelty appears in error as it is inconsistent with the "Citations and Explanations" of Box V(2). It is respectfully submitted that all pending claims, namely, claims 1-17, 19-28 and 30-50 are new in relation to the references of record, consistent with Box V(2). Furthermore, it is respectfully submitted, as discussed below, that all pending claims are unobvious in light of the references of records, more particularly, the relied upon reference combination omits one or more features of Applicant's claimed subject matter, and that said reference

-27-

combination is improper as there is no suggestion or motivation to combine same.

Applicant's Claimed Subject Matter: Independent Claims 1 & 30-34

Of the pending claims, the independent claims are claims 1, and 30-34, each of which are directed to: executing an interval branch-and-bound method to compute shading values for pixels in an image synthesis method (claim 1); a system for visible surface determination, comprising, among other things, an interval analysis processor for deterministically ascertaining a visible solution set of an area relating to a pixel (claim 30); an image synthesis method utilizing interval-based techniques requiring input of a visible solution set of a select area to a shading function for character assignment thereto (claim 31) ; an image synthesis system including, among other things, a plurality of hierarchal interval consistency solvers and mutually dependent shading routines (claim 32); providing a plurality of interval consistency solvers for sequential operation upon a series of geometric functions in a method of visible surface determination (claim 33); and, resolving parametric variables of geometric functions of a series thereof for multiple iterations of each of the geometric functions using interval consistency solvers (claim 34). Applicant's claims explicitly contemplate, singularly, or in combination as the case may be, the following features: (1) computation of shading values for pixels, or areas corresponding thereto; (2) determination of a

-28-

visible solution set of a pixels, or an area corresponding thereto; and/or, (3) a plurality of interval consistency solvers.

Claims 1-17, 19-28, and 30-50: Kant et al. in light of Snyder

It is respectfully submitted that as neither Kant et al., Snyder, or the other references record, disclose, or fairly suggest, alone or in combination, any of Applicant's claimed features, namely, computation of shading values for pixels, or areas corresponding thereto; determination of a visible solution set of a pixels, or an area corresponding thereto; and/or, a plurality of interval consistency solvers, the obviousness rejection is improper, with all claims in condition for allowance.

Kant et al.

In contradistinction to the reported characterization of Kant et al., they do not teach or suggest anything remotely resembling an image synthesis method, nor execution of an interval branch-and-bound method, let alone one for the computation of shading values for pixels. Kant et al., entitled "System and Method for Financial Instrument Modeling and Using Monte Carlo Simulation," disclose nothing more than a problem solving environment which automatically transforms a problem description into executable software code. It appears that the benefit of the Kant et al. system is that users do not have to solve complex mathematical problems within the context of a programming language such as FORTRAN. Instead, users can work in the domain of a familiar and natural mathematical environment,

-29-

exemplified by the *Mathematica* software, and then have solutions to their problems be automatically translated into highly-efficient source code or computer programs.

The Report cites Kant et al., 16:61-67, for the proposition that the reference discloses an image synthesis method. It is respectfully submitted that this is false, misleading and inapposite from Applicant's requirement. The context for Kant et al.'s "synthesis" is in the context of a discussion of "algorithm templates" (14:32 et seq.). Kant et al. describe nothing more than initiation of the process of translating a mathematical language description into a software program. During this process, decisions about the best way to solve the mathematical problem are made, and this is facilitated via selection from a list of known templates or strategies.

The Report further cites Kant et al., 18:20 through 22:23, for the proposition that the reference discloses execution of an interval branch-and-bound method. It is respectfully submitted that reliance upon this portion of their teaching is misleading, and inapposite from Applicant's requirement.

Kant et al. intend the function *f* to be given initial conditions to be solved, and the solution to be computed for variables x, y and t over the specified intervals. Numerical computation software, such as *Mathematica*, requires a user to specify interval bounds over which solutions are to be searched

-30-

for. Thereafter, Kant et al. describe in painstaking detail how a computer algebra software (CAS) system such as *Mathematica* goes about trying to solve the mathematical problem using **standard and traditional numerical methods**, not Applicant's branch-and-bound interval approach. This is made frightfully clear not only by the complete omission of any reference to interval arithmetic, interval analysis or error-bounded computing, but also due to frequent and common remarks throughout the relied upon portion of the teaching, e.g. "The RelativeErrorTolerance gives a hureistitolerance for the relative error. The System does not guarantee that this tolerance will be met." 20:28-30. The description continues, describing how there "are many other defaults that the System will use to translate the problem specification given in Table 2.1 to a numerical code. For example, the numerical code produced is, by default, is [sic] FORTRAN-77, but this can be changed to C for example." 20:36-40.

The Report further cites Kant et al., 27:52-53, for the proposition that the reference discloses splitting, in the context of Applicant's interval branch-and-bound method. It is respectfully submitted that reliance upon this teaching is misleading, false, and inapposite from Applicant's requirement

Kant et al. are clearly teaching how the invention may use many different strategies to solve a mathematical problem when translating such problem into numerical code. The list of

strategies given by Kant et al. exclusively comprises traditional point-based numerical methods, including the "splitting" method. Again, there is absolutely no frame of reference to put any of this in the context of an interval analysis approach, much less an "image synthesis method" based on interval analysis.

In summary, as to Kant et al., Applicant's features, i.e., more particularly, the features of what appears to be **only claim 1,** alleged in the Report to be shown thereby are in fact absent therefrom, and as such, any combination therewith is *ab initio* deficient, and therefore improper. Furthermore, the "Citations and Explanations" of the Report, Box V(2) make no mention of the features of Applicant's other independent claims (i.e., claims 30-34), let alone Applicant's dependent claims (i.e., claims 2-29, and 35-50), which likewise include features, and interrelationships therebetween, absent from the base reference. As such, all pending claims are patentably distinct from the references of record, and are in condition for allowance.

Snyder: Interval Analysis for Computer Graphics, pp.121-130

The subject work of Snyder, as well as his seminal work "Generative Modeling for Computer Graphics and CAD: Symbolic Shape Design Using Interval Analysis" cited in Applicant's specification, WO 2004/046881, p.26, emphasize the application of interval analysis to geometric modeling. Snyder describes how to model complex geometric shapes as a system of mathematical constraints,

-32-

resulting in an efficient and compact representation of such shapes in computer memory. However, and in contradistinction to Applicant's work, Snyder reverts to long standing heretofore methods when it comes to rendering a graphical depiction of these shapes into a rectangular array of pixels. For implicit shapes, Snyder teaches how to use interval analysis to **ray-trace (i.e., point-sample)** his highly nonlinear geometry, and for parametric shapes, he teaches how to use interval analysis to adaptively decompose the geometry into polygons, e.g., **tessellate**, and intends the polygons to be point-sampled or rasterized using conventional rendering algorithms. Absent from the work of Snyder is Applicant's error bounded rendering, and interval shading functionality, which is reflected in the claimed subject matter as previously summarized.

Having established that the primary reference, Kant et al., is directed to transforming a problem description into executable software code, and that the subordinate, Snyder, reference is directed to ray tracing/tessellation of highly non-linear implicit functions using interval analysis, it can hardly be said that there exists a motivation or suggestion from the references themselves to "cut" from Snyder a teaching directed to modeling of shapes described using implicit functions and "paste" it into Kant et al.'s software generation recipe using a natural description input. As a fundamental principle, it is respectfully submitted that there

-33-

is no motivation to look to Kant et al. at all, let alone to begin with, it arguably being non-analogous art, i.e., the problem confronting Kant et al. is quite strange to Applicant's, namely, that of the elimination of aliasing in photorealistic image synthesis. As such, in addition to the combination lacking one or more elements of Applicant's claimed subject matter, the combination is improper, and should be withdrawn.

CONCLUSION

For the reasons above, it is respectfully submitted that the subject case is in condition for allowance. Early reconsideration and such action are solicited.

Please charge any deficiencies or credit any over payment to Deposit Account 14-0620.

Respectfully submitted,

Sunfish Studio, Inc.

By their attorney

Date _April 27, 2005_

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ATTACHMENT A

10/532907

Modeler   Graphic Artist   Animator

Geometry   Lighting Textures   Motion

42

Scene Database

Network

44

Images

51   50

40

FIG. 2
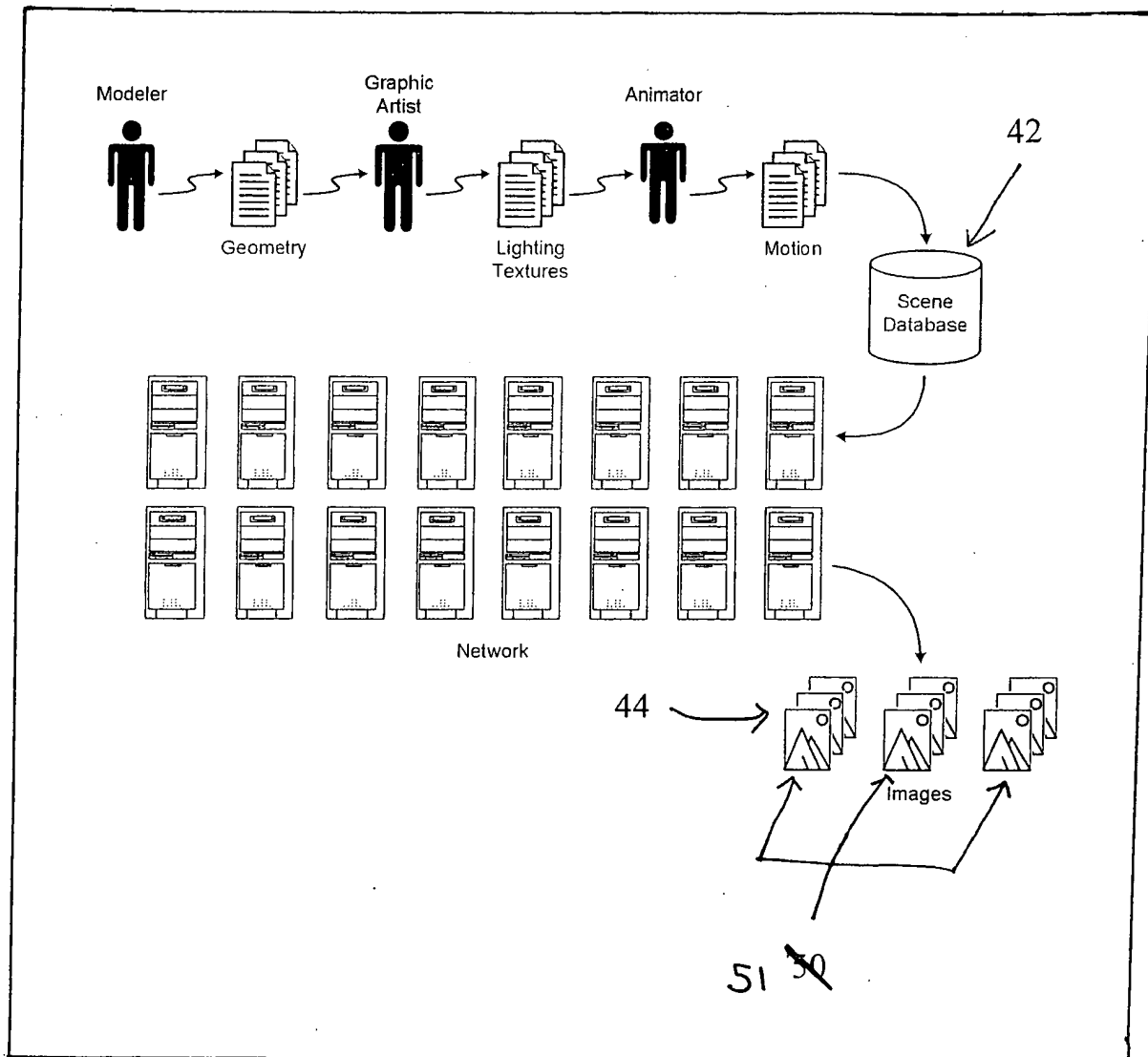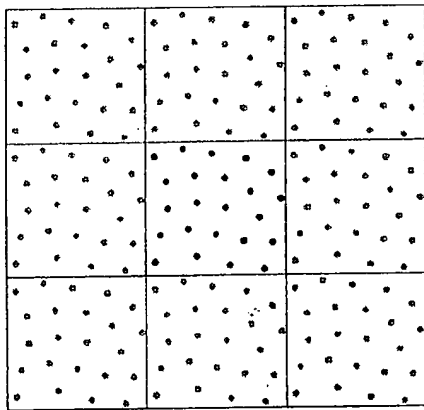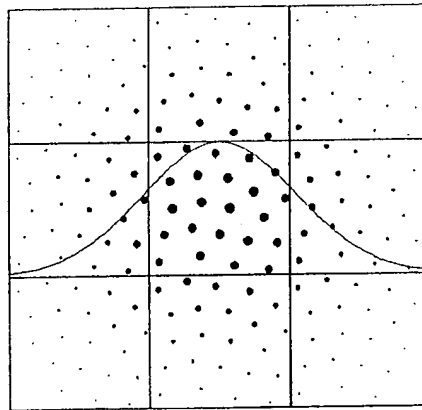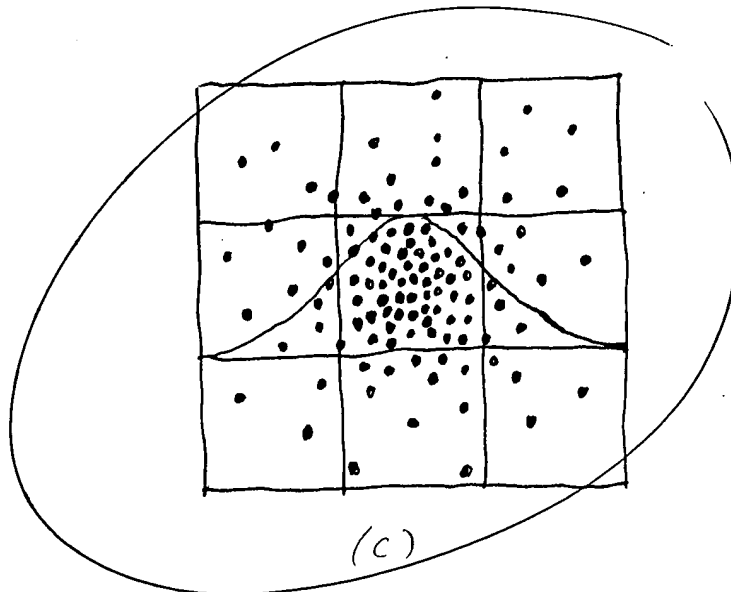
7/20

FIG. 7

(a)   (b)

REINTRODUCED,
as filed

(c)